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ABSTRACT

As a set of seven Learning Activity Packages (LAPs) for individualized instruction in chemistry, the units cover the unit system, matter, energy, atomic structures, chemical formulas, physical states of matter, solutions and suspensions, ionization, acids, bases, and salts. Each unit contains a rationale for the material; a list of behavioral objectives for the unit; a list of resources including texts, laboratory experiments, audiovisual aids, science activities, and specified questions; a problem set for student self-evaluation; suggestions for advanced study; and references. A related chemistry LAP set is SE 016 426. Pages in LAP 25 will reproduce poorly. (CC)

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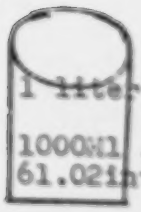
1000 grams= 1 Kg.

$D = \frac{m}{v}$

1 inch= 2.54 cm.



1000 Meters= 1 Kilometer

LAP

LEARNING
ACTIVITY
PACKAGE

INTRODUCTION TO CHEMISTRY

Ninety Six High School
Ninety Six, S.C.

CHEMISTRY I

REVIEWED BY jsh

LAP NUMBER 22

WRITTEN BY Jones

SE 016 425

Rationale (The LAP:S Purpose)

In this learning activity package, you will study various forms of matter, its properties, energy, and scientific laws. Chemistry is studied because of its' importance to industry, especially in the fields of Metallurgy, Rubber, and Nylon. Man is continually trying to produce new and better products. As a result many synthetic (man made) products are being produced by chemical processes. A knowledge of chemistry is needed in many vocations and in the development of hobbies such as Photography and Painting.

Later you will be studying atomic structure , chemical bonding,and chemical equilibrium. The information you learn from this LAP is basic to these studies.

Sections:

BEHAVIORAL OBJECTIVES

Section I.

This section deals with terms pertaining to The Science of Chemistry.

Given the required resources you will (with 70 % accuracy on the Lap Test):

Goal I: Define the following:

1. Chemistry-

2. Physics-

3. Matter-

4. Mass-

5. Density-

Goal II: Write the formula for solving density.

Goal III: Calculate the density when the mass and volume are given.

Goal IV: Name the basic units of mass, capacity, and length in the Metric System.

Goal V: Compare the English and Metric System as to volume, length, and mass.

Goal VI: Draw the Celsius and Fahrenheit thermometers and indicate the exact degrees of freezing and boiling points on each.

Section I

Self Evaluation

(Goal I) 1. Chemistry is a science that deals with (a) energy (b) natural relationships about us (c) living things and their structure (d) structure and composition of matter. _____

(Goal I) 2. Physics is a science dealing with (a) matter and energy (b) number systems (c) composition of materials and changes in composition (d) natural relationships about us. _____

(Goal I) 3. Matter (a) can't occupy space (b) has weight only (c) occupies space and has weight (d) occupies space only. _____

(Goal I) 4. The mass of a body (a) remains unchanged (b) changes (c) doubles every 10 years. _____

(Goal I) 5. The density is determined by (a) dividing the volume by the mass (b) multiplying the mass times the volume (c) dividing the mass by the volume (d) subtracting the mass from the volume. _____

(Goal II) (Goal III) 6. The density of lead is 11.34 (a) grams (b) grams per centimeter cubed (c) centimeters (d) grams per centimeter. _____

(Goal III) 7. The basic unit of length in the Metric System is the (a) meter (b) foot (c) kilogram (d) liter. _____

(Goal IV) 8. The basic unit of capacity in the Metric System is the (a) centimeter (b) gram (c) liter (d) quart. _____

(Goal IV) 9. The basic unit of mass in the Metric System is the (a) liter (b) gram (c) pound (d) meter. _____

(Goal V) 10. The meter is equal to (a) 36 inches (b) 40 inches (c) 39.37 feet (d) 39.37 inches. _____

(Goal V) 11. One kilogram is equal to (a) 2.2 ounces (b) 2.54 ounces (c) 2.2 pounds (d) 2.54 lbs. _____

(Goal V) 12. One inch is equal to (a) 2.56 centimeters (b) 2.54 centimeters (c) 2.45 centimeters (d) 2.65 centimeters. _____

(Goal VI) 13. The boiling point on the Celsius thermometer is (a) 98.6° (b) 212° (c) 100° (d) 32° . _____

(Goal VI) 14. The freezing point on the Fahrenheit thermometer is (a) 212° (b) 0° (c) 100° (d) 32° . _____

Resources

A. Text

Modern Chemistry, pp. 1-7, 11-15.

Concepts In Chemistry, p. 673.

B. Laboratory Experiments

Experiment # 2, pages 127-128.

In Lab Manual, Exercises and Experiments in Chemistry.

C. Problems and Questions

Modern Chemistry, p. 25, No. 3, 4, 5.

Modern Chemistry, p. 26, No. 16.

D. Film Strip

What is Chemistry? McGraw-Hill.

Advanced Study

Section I

BEHAVIORAL OBJECTIVES

1. Convert a number to scientific notation.
2. Write any number in scientific notation.
3. Multiply, add, divide, or subtract numbers written in scientific notation.

Activities

1. Text

   Modern Chemistry, pp. 18-22.

   General Chemistry Work book (Freeman) pp. 2-6.

2. Problems

   General Chemistry Workbook (Freeman) p. 13, No. 1, No. 2.

See Teacher for Progress Test. You must be accurate 75 % on the Progress Test. Consult the teacher.

Section II Matter and Its Changes

Given the assigned activities you will (with 75% accuracy) on the LAP Test.

Goal I Define orally or in writing the following properties of matter:

a. physical properties

b. chemical properties

Goal II Identify a reaction as a physical or chemical charge

Goal III Name and define the 2 types of mechanical energy and the two types of chemical reactions

Goal IV List 4 general forms of energy

Goal V Name and define 5 agents used to bring about or control chemical reactions

Advanced Study

Section II

Write an essay of 500 words on the conservation of matter and energy.

NOTE: You should check with your teacher before writing the essay. The essay must follow the accepted format for science papers.

See teacher for Progress Test.

You must be accurate 70 % on the Progress Test. If not consult the teacher. Proceed to Section II if you achieve 70 %.

Section II

Resources

A. Text

Modern Chemistry, pp. 8-11.

Modern Chemistry Fundamental Concepts (Geffner) pp.3-4.

Concepts in Chemistry (Greenstone, Sutman, and Hollingsworth, p. 9.

B. Laboratory Experiments

Exercises and Experiments in Chemistry, Experiment # 4, p. 131.

C. Questions

Modern Chemistry, p.45, No. 3, 4, 5.

D. Filmstrip

"Energy of Reactions" # 10808 EB

E. Loops

Heat Effects-Chemical and Phase Change Compared

Parts I and II #96-2152 b

Self-Evaluation

Section II

Goal

I. Select the letter of the correct answer

(I)(III) 1. Choose the example that is not a physical property

(a) density (b) color (c) oxidizing ability (d) melting and boiling points _____

2. Select the example that is a chemical property

(a) ability to burn (b) hardness (c) crystalline or amorphous (d) melting point _____

3. The 2 forms of mechanical energy are

(a) electrical and chemical (b) chemical and potential (c) radiant and potential (d) kinetic and potential _____

4. Select the item that is not an example of potential energy

(a) water behind a dam (b) a lump of coal (c) football at rest (d) log that is burning _____

(II) II. Indicate whether each involves a physical or chemical change

(a). sugar dissolving _____

(b) ice melting _____

(c) a knife rusting _____

(d) leaves changing color _____

III. Define

a. endothermic _____

b. exothermic _____

c. kinetic energy _____

d. potential energy _____

(IV) IV. List 3 forms of energy other than mechanical energy

a. _____

b. _____

c. _____

(V) V. Electric and light energy are agents that bring about or control chemical changes. Name 3 other agents.

a. _____

b. _____

c. _____

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LAP

LEARNING

ACTIVITY

PACKAGE

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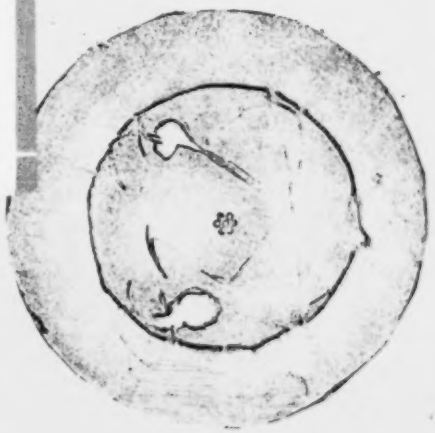

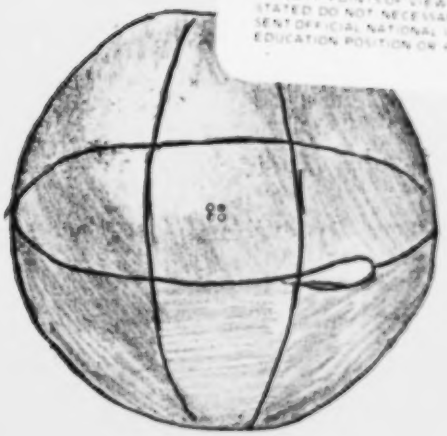

·Tl· ·Pb· ·Bi:
·Po: :At: :Rn:

·In· ·Sn· ·Sb:
·Te: :I: :Xe:

ATOMIC STRUCTURE

Ninety Six High School · Ninety Six, S.C.

CHEMISTRY I

REVIEWED BY J. S. Pitalo

LAP NUMBER 23

WRITTEN BY Naomi Jones

SE016425

RATIONALE (THE LAP'S PURPOSE)

Have you ever thought about how difficult it is to unlock the mysteries of the earth? A cube of sugar dissolves in water, but a piece of sodium reacts violently with water. Yet sodium and sugar are made up of similar atoms.

In this learning activity package you will bring together the history and experimental evidence that was responsible for the development of Dalton's Atomic Theory. Dalton's theory left these important questions unanswered. If atoms were hard invisible particles, how could atoms of different elements combine to form compounds? Why did some elements combine readily and others not as readily? You will also consider the arrangement of electrons within atoms, the make-up and distribution of electron shells, and the different methods of representing atomic structure.

In order to proceed through a course in basic chemistry there must be a basis for explaining physical and chemical changes. All changes involve interaction of atoms which necessitates an acceptable model for the atom.

BEHAVIORAL OBJECTIVES

Section I

After completing the suggested activities you will be able to (with 70% accuracy on the LAP Test)

Goal I.

1. State how the early Greek scholars defined matter.
2. List the contributions of the Alchemists
3. Write Bohr's definition of an atom

Goal II. Define

1. atoms
2. Isotope
3. atomic number
4. Mass number
5. Avogadro number
6. mole
7. atomic mass

Goal III.

Calculate the number of grams of atoms in one mole of an element.

Goal IV.

1. List the 2 parts of an atom
2. List the kinds of particles found in the 2 parts of an atom
3. Compare the size of the particles in an atom.

ACTIVITIES

I. Textbooks

1. Modern Chemistry (Holt) pp. 28-40
2. Concepts in Chemistry (Harcourt) pp. 23, 25, 29, 132-133
3. Chemistry (Silver Burdette) pp. 68-80, 200-201
4. Pathways In Science (Globe) pp. 72, 149-150 (paperback)
5. Modern Chemistry Concepts (Geffner) pp. 32-33

II. Films and filmstrips:

The Atom Eyegate House

Atomic Energy Encyclopedia Britannica

Period Table McGraw Hill Company

Explaining Matter : Atoms and Molecules Encyclopedia Britannica

III. Charts:

Periodic table chart

SELF EVALUATION TEST

Goal I 1. Greek scholars believed (1) matter was destructible (2) matter could not be divided (3) matter did not exist (4) matter was indestructible _____

Goal I 2. The theory that electrons move about the nucleus of an atom in orbits was given by (1) Dalton (2) Democritus (3) Chadwick (4) Bohr _____

Goal IV 3. Which of the following is not one of the four basic elements identified by the early Greek scholars (1) fire (2) heat (3) air (4) water _____

Goal IV 4. The part of the atom that is very small and dense is the (1) electron shells (2) nucleus (3) energy levels (4) electron _____

Goal IV 5. The particle that has the smallest mass is the (1) proton (2) neutron (3) hydrogen nucleus (4) electron _____

Goal II 6. A mole consists of the number of chemical units given by the (1) atomic number (2) mass number (3) avogadro number (4) Isotope number _____

Goal II 7. Isotopes of a given element have identical (1) mass number (2)nuclear structure (3)atomic number (4) atomic weights _____

Goal II 8. The mass in grams of one mole of naturally occurring atoms of an element is called the element is called the elements (1) atomic weight (2) gram atomic weight (3) atomic number (4) mass number _____

Goal III 9. The smallest particle of an element that can exist either alone or in combination with other particles of the same element is the (1) electron (2) proton (3) neutron (4) atom _____

Goal II 10. The atomic mass of an atom is its mass expressed relative to the mass of a standard atom which is assigned a relative mass of exactly 12. This standard is the most common isotope of (1) hydrogen (2) oxygen (3) carbon (4) helium _____

Goal III 11. The number of moles of atoms in 6.078 grams of magnesium (atomic weight 24.312) is (1) 1.0 (2) 0.500 (3) 0.250 (4) 4.00 _____

Goal II 12. The Avogadro number of particles is (1) 90.3×10^{23} (2) 6.02×10^{23} (3) 70.2×10^{23} (4) 4.01×10^{23} _____

ADVANCED STUDY

1. Why was carbon 12 developed as a new standard for relative atomic weights.

2. If 1 gram-atom of lithuim weighs 6.94 grams, calculate the approximate weight of a single lithuim atom.

3. Make a chart of 7 Isotopes giving the atomic numbers, mass number, and composition of nucleus. (number of protons and neutrons)

*See the teacher for your Progress Test.

SECTION II

BEHAVIORAL OBJECTIVES

After completing the suggested activities you will be able to (with 70% accuracy on the LAP test)

Goal I. List the 4 Quantum numbers

Goal II. Define the following:

1. octet
2. The 4 Quantum numbers listed in Goal I

Goal III. Write the principal Quantum number, energy level, or shell for a given element.

Goal IV. List the maximum number of electrons that can be found in each energy level.

Goal V. Name the letter designations for the secondary Quantum Number

Goal VI. Illustrate the orbital notation for all of the first 20 elements in the Periodic Table.

Goal VII. Write the Electron Configuration for all of the first 20 elements in the Periodic Table.

Goal VIII. Draw the Electron Dot diagram for all of the first 20 elements in the Periodic Table.

ACTIVITIES SECTION II

I. Textbooks

1. Modern Chemistry (Holt) pp. 54-57
2. Concepts In Chemistry (Harcourt) pp. 42-46, 48-51, 55-56
3. Fundamental Concepts of Modern Chemistry (Geffner) pp. 385- 400
4. Atomic Units (Merrill)
5. Chemical Systems (CBA) pp. 32-36

II. Pamphlets

1. Inside the atom (General Electric)
2. The World Within The Atom (Westinghouse)
3. Frontiers of Nuclear Physics (American Publications)
4. Atoms, Crystals, Molecules (American Publications)

III. Films and Filmstrips*

1. Atomic Energy - Encyclopedia Britannica
2. The Atom - Eye Gate House Inc.

*3. Atomic Structure And Chemistry - McGraw Hill

SELF EVALUATION TEST

Section II

Heal II 1. A set of four quantum numbers describes all of the following characteristics of an orbital except (1) shape (2) position with respect to the nucleus (3) spatial orientation (4) direction of spin (5) none of the above ____

Heal II 2. The number of possibilities for electron spin is (1) 1 (2) 2 (3) 3 (4) 4 ____

Heal IV 3. The maximum number of possible electrons that can be found in the 0 or 5th energy level is (1) 8 (2) 18 (3) 2 (4) 32 ____

Heal III 4. The highest energy level for an atom of Potassium is (1) K or 1 (2) L or 2 (3) M or 3 (4) N or 4 ____

Heal VII 5. The following electron configuration $1S^2 2S^2 2P^3$ is for : (1) neon (2) manganese (3) Lithium (4) Nitrogen ____

Heal VIII 6. The following electron dot diagram Ca: is for the element (1) Potassium (2) Carbon (3) Calcium (4) Cadmium ____

Heal V 7. Label the subshells for energy level M or 3 (1) S (2) S,P (3) S,P,D (4) S,P ____

Heal II 8. The Quantum number which indicates the average distance of the the electron from the nucleus of the atom is called (1) magnetic quantum number (2) Principal quantum number (3) Secondary quantum number (4) Spin quantum number ____

Heal II 9. The name given to an outer shell containing eight electrons is (1) sub level (2) Octet (3) sub orbital. (4) quantum ____

Heal VI 10. Electron orbital notations show (1) electrons in the outer shell (2) electrons in the first energy level (3) all electrons (4) last energy level

ADVANCED STUDY SECTION II

1. Why are there only two elements in the first row of the Periodic Table and eight elements in the second row?

2. A. Make a chart of Electron Notations for

   1. Lithium
   2. Neon
   3. Potassium
   4. Krypton
   5. Nickel
   6. Copper
   7. Bromine
   8. Silver
   9. Tin
   10. Antimony
   11. Barium
   12. Lead
   13. Bismuth
   14. Tungsten

   B. In the chart show
      1. Symbol
      2. Atomic number
      3. Number of Electrons in Sublevels

* See the teacher for your progress test. If you score 70% or above go on to the LAP test. If not see the teacher. If you score 70% or above on the LAP test proceed to next LAP.

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LEARNING ACTIVITY PACKAGE

CHEMICAL FORMULAS

HCl	NaCl
H_2O	$CaCl_2$
NH_3	$AlCl_3$
CH_4	CCl_4

CHEMICAL FORMULA WRITING

Ninety Six High School - Ninety Six, S.C.

CHEMISTRY I

REVIEWED BY _____

LAP NUMBER 24

WRITTEN BY N.Jones

SE016 425

I. Rationale (reason why)

You have completed your study on atomic structure showing how reactions occur between atoms. Now, you will learn to write a shorthand method used by chemists for describing substances and the changes they undergo.

Consider this statement "Two molecules of a gas containing two atoms of carbon and two atoms of hydrogen in each molecule will react with five molecules of a gas containing two atoms of oxygen in each molecule to produce four molecules of a gas containing two atoms of oxygen and one carbon atom in each molecule". This is extremely wordy. This could be shown by writing:

$$2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 2H_2O.$$

In this LAP you will be writing symbols, formulas, equations and balancing equations which will be beneficial in studying all the LAPs that follow in Chemistry.

Chemical Formulas and Equations

Section I Chemical composition and chemical bonds

I. Define:

valence	valence electrons
radical	chemical formula
molecular formula	empirical formula
molecular weight	chemical bond
oxidation	reduction
electronegativity	formula weight

II. Write the formula or symbol for common ions and give the valences of each.

III. Define binary compounds and be able to name any compounds when the formulas are given.

IV. Find the formula weight of any compound specified.

V. Find the percentage composition of any compound.

VI. Define mole and give the number of moles in any given compound or determine the mass.

VII. Determine the Empirical formula of a compound from the percentage composition of the compound.

VIII. Apply the rules of oxidation numbers and explain in writing how elements may have several oxidation numbers.

IX. Write 5 values of electronegativities and show the relationship between electronegativity difference and ionic character.

X. Define ionic and covalent bonding- giving the conditions under which these bonds are produced. Select from a list examples of ionic and covalent bonding.

XI. Define multiple covalent bonds and predict the number of covalent bonds between atoms in examples.

XII. Write equations showing the energy change in ionic bonding.

RESOURCES

I. Books

1. Chemistry by Smoot, Price, Barrett pp. 52-72
* 2. Modern Chemistry Holt, Rinehart, Costka pp. 79-113
3. Concepts In Chemistry Sutman, Harris pp. 115-121
4. General Chemistry Workbook, Pierce and Smith pp. 77-79
5. Solving Problems In Chemistry by Himes pp. 66-70

II. Experiments- None

Special Instructions

III. A. With the completion of this entire LAP do exercise 3 and 4 in Exercises and Experiments In Chemistry pp. 7-10.

B. Write out the answers and hand in questions 16, 18, 19, 20 page 50 in Modern Chemistry by Holt, Rinehart and Winston.

C. Write out and hand in the answers to questions 11, 12, 19 pp. 62 in Modern Chemistry by Holt, Rinehart and Winston.

IV. Transparencies

Eyegate No. 540 - 003-29

Eyegate No. 540 - 003-11

V. Charts

Atomic Orbital Chart

Periodic Chart

Advanced Study

I. Balance each of the following equations

1. $FeCl_3 + NH_4OH \longrightarrow Fe(OH)_3 + NH_4Cl$

2. $Cu_2S + HNO_3 \longrightarrow CU(NO_2)_2 + CuSO_4 + NO_2 + H_2O$

3. $CH_4 + O_2 \longrightarrow CO_2 + H_2O$

4. $Ce(IO_3)_4 + H_2C_3O_4 \longrightarrow C_2(C_2O_4)_3 + I_2 + CO_2 + H_2O$

5. $MnCl_2 + Br_2 + NH_4OH \longrightarrow MnO_2 + NH_4Cl + NH_4Br + H_2O$

II. Find out how light affects the emulsion on a photographic film. What chemical reactions are involved in the developing of the film?

III. A. Find out what is meant by "flash point"

B. What kind of reaction is a metathesis reaction ?

C. Why are some foods and beverages stored in brown bottles?

Self-Evaluation Section 1 LAP 24

Goal I Fill in the blanks

1. The formula representing the simplest whole number ratio of atoms of the constituent elements in a compound is _____

2. A formula using chemical symbols to represent the composition of a compound _____

3. A chemical formula denoting the constituent elements and the number of atoms of each _____

4. Any chemical reaction which involves the loss of one or more electrons by an atom _____

5. Any chemical reaction which involves the gain of one or more electrons _____

6. The formula weight of a molecular substance _____

7. The sum of the atomic weights of all the atoms present in a chemical formula _____

8. One of the electrons in an incomplete outer shell of an atom. _____

9. The property of an atom of attracting the shared electrons forming a bond between it and another atom. _____

10. A charged group of covalently bonded atoms. _____

Goal II Complete

Name	Formula	Valence
1. Carbonate		
2. Peroxide		

3. Mercury (II)

4. Hydrogen Sulfate

5. Chromate

6. Barium

7. Ammonium

8. Silver

9. Chromium

10. Sulfide

Goal III Supply the name of each compound

1. CCl_4 _____

2. As_2S_5 _____

3. Su Cl _____

4. $Ph(NO_3)_2$ _____

5. $Na_3(PO_4)$ _____

6. NH_4NO_3 _____

7. $AgC_2H_3O_2$ _____

8. Cu_2S _____

9. FeO _____

10. CO _____

Goal IV. The formula weights of the following are

1. K_2SO_4 _____

2. $Ba(OH)_2 \cdot 8H_2O$ _____

3. $Ca(OH)_2$ _____

4. Fe_2O_3 _____

5. $Na_2CO_3 \cdot 10H_2O$ _____

6. $2C_{12}H_{22}O_{11}$ _____

Goal V

1. Determine the percentage composition of iron in Fe_2O_3.

   A. The formula weight of Fe_2O_3 is _____

   B. The percent of iron in Fe_2O_3 is _____

2. Determine the percentage of oxygen in CO_2

   A. The formula weight is _____

   B. The percent of O_2 is _____

3. Determine the percentage composition of $Ca_3(PO_4)_2$

   A. The formula weight of $Ca_3(PO_4)_2$ is _____

   B. The percent of calcium is _____

   C. The percent of oxygen is _____

Goal VI. Select the letter of the correct answer

1. Two moles of hydrogen molecules has a mass of

   (a) 1 gram (b) 2 grams (c) 8 grams (d) 4 grams _____

2. The number of moles of sodium chloride represented by 117 g. of this compound is

   (a) 1 (b) 2 (c) 3 (d) 4 _____

3. The number of moles of hydrogen atoms in 0.50 mole of natural hydrogen gas is

   (a) 1.0 (b) 0.25 (c) 0.50 (d) 2.0 _____

4. 400 g. of $Ca(C_2H_3O_2)_2$ is equal to how many moles of $Ca(C_2H_3O_2)_2$

   (a) 4 moles (b) 2.53 moles (c) 2.35 moles

   (d) 4.5 moles _____

Goal VII.

1. What is the empirical formula for a compound

with composition of 50 % Fe and 30 % O_2 ?

(a) FeO (b) Fe_7O_3 (c) Fe_3O_4 (d) Fe_2O_3_____

2. What is the empirical formula for a compound that is 1.24% hydrogen and 98.56 % Bromine.

(a) HBr_2 (b) H_2Br (c) H_3Br (d) HBr_____

3. A certain compound was found by analysis to be 27.48% magnesium, 23.6 % phosphorus, 48.58% oxygen. It correct empirical formula is

(a) $Mg_2(PO_4)_2$ (b) $Mg_3(PO_4)_2$ (c) $Mg(PO_4)$

(d) $Mg_3(PO_4)$ _____

Goal VIII Complete the blanks

1. The oxidation number for each atom of a free element is _____

2. The oxidation number of metallic sodium is_____

3. The oxidation number of the copper II ion is_____

4. The usual oxidation number of oxygen is_____

5. The sum of oxidation numbers of all atoms in calcium chloride is _____

6. What is the oxidation number of nitrogen in the nitrate ion _____

Goal IX. Complete the blanks

1. The electronegativity difference for covalent bonds is _____

2. The range electronegativity difference for ionic bonds is _____

3. The more active metals have (higher, lower) electronegativities _____

4. The gases that aren't assigned electronegativities are _____

5. The most electronegative element is _____

6. The second most electronegative is _____

Goal X Write in the blank whether the following are ionic or covalent

A.

1. MgO _____

2. HF _____

3. NO_2 _____

4. KI _____

5. SO_2 _____

B.

1. In covalent bonding ions are _____

2. In ionic bonding ions are _____

Goal XI Write the number of bonds for each

1. Na_2SO_4 _____

2. C_2H_6 _____

3. CH_4 _____

4. F_2 _____

5. SiO_2 _____

6. P N _____

Goal XII

1. Write the equation showing the ionization energy of sodium _____

2. Write the equation showing the electron affinity of chlorine _____

3. Write the equation for the breaking up of magnesium. _____

Section II Chemical Formulas and Equations LAP 24

Behavioral Objectives

Goal I Write chemical formulas correctly by supplying the symbols and valences of each element present.

Goal II Write chemical formulas for compounds that contain radicals, supplying the correct valences and subscripts.

Goal III State how some elements have variable valences and write compounds with variable valences and name the compound.

Goal IV Determine the valence number of elements within a radical.

Goal V Determine the use of coefficients in equations and the total number of atoms in compounds.

Goal VI A. Balance any equation

B. Define product, reactant and balanced equation.

Self-Evaluation Section II Chemical Formulas and Equations

Goal I

1. Write the chemical formulas for the following.

a. sodium oxide _____

b. calcium fluoride _____

c. potassium nitrite _____

d. antimony trichloride _____

e. mercury II chloride _____

f. Iron II oxide _____

g. cuprous sulfide _____

h. sodium peroxide _____

i. diarsenic pentasulfide _____

j. carbon monoxide _____

Goal I

2. Write the valence in the blank of the underlined element in each compound.

a. $\underline{Mg}Cl_2$ _____

b. $Ca\ \underline{F}_2$ _____

c. $\underline{Fe}_2\ O_3$ _____

d. Mg $\underline{O}$ _____

e. $Zn\ \underline{I}_2$ _____

f. $\underline{Na}$ Cl _____

g. $\underline{K}$ Br _____

h. $\underline{Ag}$ O _____

i. K $\underline{I}$ _____

j. Ca $\underline{Br}_2$ _____

Goal III 3. Name these compounds

1. $NH_4(NO_2)$ _____
2. $Mg_3(PO_4)_2$ _____
3. $Fe(SO_4)$ _____
4. Na_2O_2 _____
5. $HgCl_2$ _____
6. $Fe(OH)_3$ _____

B. Give the valences of the following

1. Iron II _____
2. Iron III _____
3. Mercury II _____
4. Chromium _____
5. acetate _____

Goal IV A. Write the valence number of the following

1. (NH_4) _____
2. (CO_3) _____
3. (PO_4) _____
4. CrO_4 _____
5. HCO_3 _____
6. H_3O_4 _____
7. $C_2H_3O_2$ _____

B. What is the valence of each underlined element in the radicals?

1. $\underline{S}O_4$ _____
2. $\underline{P}O_4$ _____
3. $\underline{Si}O_3$ _____
4. $H\underline{C}O_3$ _____
5. $H_2\underline{Cr}O_4$ _____

Goal V Give the total number of atoms present in the following

1. HCO_3 _____
2. $C_2H_3O_2$ _____
3. $2H_2SO_4$ _____
4. $5H_2O$ _____
5. $2Na_2(SO_4)$ _____
6. $Al_2(CO_3)_3$ _____

Goal VI A. Balance the following equations

1. $C + O_2 \rightarrow CO_2$ _____
2. $Cu + O_2 \rightarrow CuO$ _____
3. $Na_2O_2 + H_2) \rightarrow Na(OH) = O_2$ _____
4. $AgNO_3 + HCl \rightarrow AgCl + HNO_3$ _____
5. $P + O_2 \rightarrow P_{14}O_{10}$ _____
6. $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCL$ _____
7. $Al_2(SO_4)_3 + Ca(OH)_2 \rightarrow CaSO_4 + Al(OH)_3$ _____
8. $Al + FeCl_3 \rightarrow Al_2Cl_3 + Fe$ _____
9. $KClO_3 \rightarrow KCl + O_2$ _____
10. $Ca(NO_3)_2 + NaCl \rightarrow CaCl_2 + Na(NO_3)$ _____

B. Name the products of the following reactions

1. zinc + copper(II) Sulfate a. _____
2. copper + chlorine b. _____
3. calcium oxide + water a. _____
4. phosphorus + oxygen a. _____
5. hydrochloric acid + sodium hydroxide a. _____
   b. _____

ED 086479

PHYSICAL STATES OF MATTER

LAP

LEARNING ACTIVITY PACKAGE

Hexagonal

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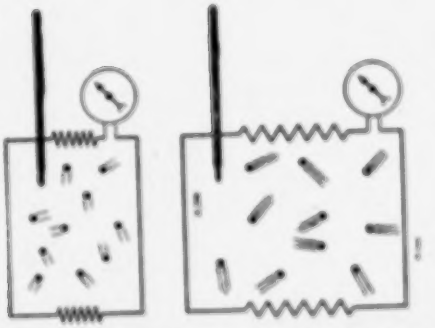
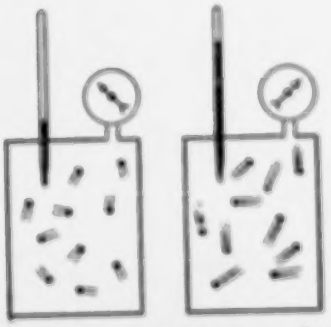
$$V' = V \times \frac{P}{P'} \times \frac{T'}{T}$$



. At constant pressure, as the temperature of a gas increases, the volume it occupies increases.

$Na_2CO_3 \cdot 10\,H_2O$,



. At constant volume, as the temperature of a gas increases, the pressure it exerts increases.

Ninety Six High School
Ninety Six, S.C.

Chemistry I

REVIEWED BY A Ritchie

LAP NUMBER 25

WRITTEN BY N. Jones

SE 016 425

RATIONALE: (reason why)

"Our experiments are questions that we put to nature."
- Niels Bohr

You have just completed your study of chemical formulas and equations. In this LAP you will be applying this knowledge in studying the physical states of matter which involves the study of Gas Laws, molecular composition of gases and the general study of liquids and solids. It is through the study of the properties of gases that we have gained the most useful explanations for the nature of all forms of matter and especially so in the case of solutions and suspensions which you will study in your next LAP.

BEHAVIORAL OBJECTIVES:

After completing your prescribed course of study, unless otherwise specified, you will be able to demonstrate your knowledge of the following objectives in a Progress and/or LAP Test.

I. Discuss orally or in writing all of the following properties of gases in terms of molecular kinetics. (Kinetic Theory)

1. temperature
2. pressure
3. compressibility
4. diffusion

II. Solve the following:

1. Using Boyle's Law: determine the new volume at a new pressure.

2. Using Charles' Law: determine the new volume at a new temperature.

3. Using a combination of these laws. Given the temperature, volume and pressure, determine:

a. The new volume when given the new temperature and pressure.
b. The new pressure when given the new volume and temperature.
c. The new temperature when given the new volume and pressure.

III. a. Determine the pressure of a dry gas if it is collected over water in a eudiometer tube in the laboratory.

b. Determine the pressure of a gas collected over mercury.

IV. a. Determine the density of any gas under standard conditions.

b. Determine the specific gravity of gases.

c. Convert Celsius readings to Kelvin.

V. a. Name the 6 crystalline systems.

b. Make drawings of each of the 6 crystalline systems.

c. Demonstrate that you understand ionic crystals, covalent crystals, and metallic crystals by naming or selecting examples of each.

VI. Discuss orally or in writing:

a. The stability of water

b. Behavior with metals

c. Water of crystallization

d. Behavior with metallic oxides

VII. a. Write the possible types of molecules in H_2O.

b. Name the 3 possible isotopes involved in H_2O.

c. Name the 3 possible ions found in water.

REFERENCES:

I. "Concepts in Chemistry", Harcourt-Brace, pp. 146-150

II. "Modern Chemistry", Holt, Rinehart, Winston, pp. 125-182

III. "General Chemistry", Selwood, pp. 57-74

IV. "Chemistry", Silver Burdett, pp. 138-139

Filmstrips:

Boyle's Law - No. 108 09 EB

Charles' Law - No. 108 10 EB

Cassette:

Wallensak - C-7706 - Temperature Conversion

Activities:

I. Complete Exercise 9, page 31, in your Laboratory Manual on "The Gas Laws."

II. Complete Exercise 10, page 33, in your Laboratory Manual on "Molecular Composition of Gases."

III. Hand in the following problems in Group B, page 157, of your textbook - 29, 30, 31 and 32.

IV. There are no experiments.

Self-Evaluation

Chemistry I - LAP #5

I. Select the letter of the correct answer.

GOAL I

1. The expression "a cubic foot of air" is unsatisfactory because (a) air volume is negligible (b) air has a very low density (c) gas volume is dependent on its temperature and pressure (d) gas volumes are hard to measure. _____

2. According to the Kinetic Theory, gas molecules have these characteristics except (a) moving rapidly in random fashion (b) filling all available space (c) diffusing at the same rate. _____

3. The temperature of a gas is an indication of the (a) average energy of the gas molecules (b) ~~the~~ heat energy of the gas molecules (c) total energy of the gas molecules (d) large volume of space between the molecules. _____

4. The expression standard temperature is (a) the Celsius temperature of melting ice (b) the Celsius temperature of boiling water (c) zero degrees Kelvin (d) the Kelvin temperature of steam. _____

5. The process of spreading out spontaneously to fill a space uniformly is characteristic of gases and is known as (a) condensation (b) diffusion (c) evaporation (d) nonpolarity. _____

6. The low density of a gas is determined by (a) the gas particles bombarding the walls of the container (b) the particles simply moving apart (c) the particles of the gas being far apart (d) the particles moving in between other gas particles.

II. GOAL III A gas collected is collected over water at 22°C. The vapor pressure of the water at 22°C is 23.6 Mm. and the barometer reading is 760 MN. What is the pressure of the dry gas? (a) 756 Mn. (b) 23.6 Mn. (c) 732.4 Mn. (d) 779.6 Mn. _____

III. GOAL III A eudiometer tube contains a gas sample collected over water. The water level inside the tube is 20.4 Mm. higher inside than outside. The pressure is 730 Mm. and the temperature is 22°C. The corrected pressure due to the difference in levels is (a) 709.6 Mm. (b) 750.4 Mm. (c) 755 Mm. (d) 728.5 Mm. _____

IV. GOAL II In an experiment 35 Ml. of hydrogen was collected in a eudiometer over mercury. The mercury level inside the eudiometer was 40 Mm. higher than that outside. The temperature was 25°C and the barometric pressure was 740 Mm. Correct the volume of hydrogen to STP. (a) 29.5 Ml. (b) 39.5 Ml. (c) 50.6 Ml. (d) 480 Ml. _____

4 (con't)

Self-Evaluation - Chemistry I - LAP 25 (con't from p. 4)

V. 1. What is the density of sulfur dioxide under standard conditions? _____

GOAL IV

(a) .64 grams per liter (b) 2.89 grams per liter

(c) .35 grams per liter (d) 2.14 grams per liter

2. 6×10^{23} molecules of a gas equals (a) one mole (b) a molar volume (c) 22.4 liters under standard conditions (d) all of these _____

3. Change the following temperatures to the Kelvin Scale.

(a) 20°C _____ (b) 85°C _____

(c) -15°C _____ (e) -100°C _____

VI. 1. To find the specific gravity of oxygen using air as a standard, divide the mass of one liter of oxygen by (a) 1 (b) 1.29 grams/liter (c) 22.4 liters (d) 1.43 grams/liter. _____

GOAL IV

2. One liter of gas has a mass of 0.774 grams. Calculate its specific gravity, air standard. _____

(a) 12 (b) .600 (c) .60 (d) .120

VII. 1. The smallest portion of the crystal lattice which determines the pattern of the lattice structure is the (a) molecule (b) cube (c) unit cell (d) ion

GOAL V

2. The crystal system in which the 3 axes are at right angles, but only the two lateral axes are equal is (a) cubic (b) tetragonal (c) triclinic (d) orthorhombic _____

3. Crystals of common table salt (NaCl) are (a) isometric (b) octahedral (c) triclinic (d) orthorhombic _____

4. Generally speaking, compounds consisting of Groups I & II metals with Groups VI & VII nonmetals, are (a) ionic crystals (b) covalent crystals (c) metallic crystals (d) molecular crystals _____

5. Crystals that are hard, have high melting points, and are nonconductors are classified as (a) ionic crystals (b) molecular crystals (c) covalent crystals (d) metallic crystals _____

VIII. GOAL VI.

1. As liquid water solidifies its (a) volume decreases (b) mass increases (c) volume increases (d) density increases _____

2. In the water molecule, the angle between the two hydrogen-oxygen bond is (a) 180° (b) 105° (c) 90° (d) 60° _____

3. In liquid water, the number of molecules usually ranges from (a) 2-3 (b) 5-6 (c) 3-4 (d) 4-8 _____

4. Water reacts with oxides of several non-metals to form a(n) (a) anhydride (b) hydride (c) solution containing a base (d) solution containing an acid _____

5. Water of hydration is driven off from a crystal by (a) dissolving the crystal (b) heating the crystal strongly (c) filtration (d) adding an acid _____

6. Hydrated crystals contain (a) anhydrous compounds (b) non-polar bonds (c) hydrated ions (d) none of these _____

IX. 1. What two particles are present in water besides ordinary H_2O molecules?

a. _____

b. _____

2. How many isotopes of hydrogen are there? _____

3. Write the formula for the hydronium ion. _____

4. Give the formula for heavy water. _____

5. Name the three possible ions found in water.

a. _____

b. _____

c. _____

Advanced Study:

1. Molecular weights of materials are often found today by using a mass spectrograph. Write a paper on how a spectrometer works in this regard.

2. Find out what the Law of Hess is and how to use it in energy calculations. Make a written report.

3. Look up the lives of W. E. Bragg and W. L. Bragg. Write a report on the processes they used to determine crystal structures.

4. Transistors work because they contain crystal defects. Write a report on how transistors work.

5. a. Make models of each crystal system.
   b. Collect crystals which illustrate each system.

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LEARNING ACTIVITY PACKAGE

SOLUTION AND SUSPENSIONS

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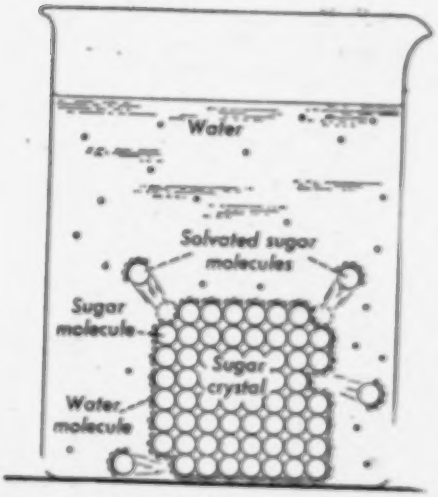
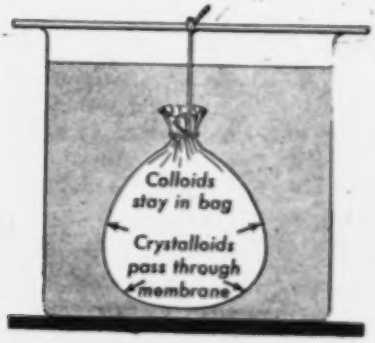
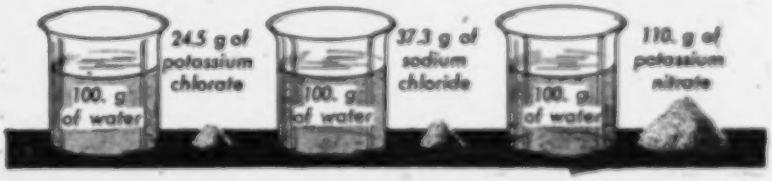


A possible mechanism of the solution process.



comparison of the amounts of three common solutes that can be dissolved in 100. g of water at 60.° C.



Ninety Six High School - Ninety Six, S.C. - 1001

Chemistry 1

REVIEWED BY

LAP NUMBER 26

WRITTEN BY N. Jones

SE 016 425

RATIONALE: (Reason Why)

Is a window pane a liquid? Is a hard lump of paraffin a solid? Such questions may seem to have easy answers but they really do not. A search for the answer comes through the forces acting between the atoms and molecules and in the scientific meaning of the words. Problems of solubility are problems in chemical equilibrium. After studying the previous Laps, you are able to confront the problems and arrive at complete and logical answers. This Lap will give you the proper background for your next study of Ionization.

BEHAVIORAL OBJECTIVES:

After completing the program of instruction, you will be able to:

I. Demonstrate your understanding of the following terms by writing definitions and giving examples of each.

   a. dissolve and melt

   b. miscible and immiscible

   c. dilute and concentrated

   d. solute and solvent

   e. adsorption and absorption

   f. molality and normality

   g. suspensions and saturated solutions

II. Determine the influence of temperature and pressure upon the solubility of:

   a. a gas in a liquid

   b. a solid in a liquid

III. Distinguish between the following:

   a. true solutions and colloidal suspensions

   b. internal and external phases of colloidal solutions

   c. Brownian movement and the Tyndall effect

IV. List nine possible types of solutions and give examples of each.

V. A. Explain the term saturated solution in terms of solution equilibrium

   B. Explain the types of colloids and list reasons why colloidal suspensions don't settle upon standing

VI. Demonstrate the methods by which suspensoids may be prepared and precipitated

VII. Compare emulsoids and suspensoids

RESOURCES

I. Books:

a. "Modern Chemistry" - by Holt, Rinehart and Winston
pp. 183-201
pp. 217-251

b. "Concepts in Chemistry" - by Harcourt and Brace
pp. 180-200

c. "Chemistry" - by Smoat, Barrett and Price
pp. 307-314

d. "General Chemistry - by Selwood
pp. 202-219

e. "Modern Chemistry, Fundamental Concepts" by Geffner
pp. 162-182

SPECIAL ACTIVITIES

* Experiments:

"Exercises and Experiments" by Metcalfe, Williams, Castka

1. "Colloidal Suspensions" - Experiment 32

   (Complete all questions concerning colloidal suspensions on page 210 in your Lab Manual)

2. "Adsorption" - Experiment 33
   pp. 211-212

3. "Solubility," "Rate of Solution," "Heat of Solution"
   Experiment 22
   pp. 175-178

4. "Solubility Curve" - Experiment 21
   pp. 179-180

5. "Solution and Molecular Polarity"
   pp. 167-169

* Exercises:

1. Exercise 15
   pp. 53-54

2. Exercise 12
   pp. 43-46

* Problems 1, 3, 4

Pg. 201 in Modern Chemistry

* Cassettes or Film Loop - A. B. Dick

Parts I and Parts II
Heat Effects - Chemical and Phase Change compared

ADVANCED STUDY

I. Assume that you have a substance whose molecular weight is known. Describe an experiment that you could perform to show (a) that the compound produces ions in solution (b) the number of ions formed per molecule of the compound.

II. a. In what respects does the dissolving of a solid in water resemble the melting of a solid?

b. In what ways are the two processes different?

III. a. Explain why dissolving many compounds in water involves both chemical and physical changes.

b. Explain whether or not a chenical change occurs when carbon tetrachloride dissolves in Octane.

IV. In absolutely pure water, the water molecules are linked in groups by hydrogen bonding. Alcohol molecules are linked by hydrogen bonding. What changes take place when alcohol dissolves in water?

SELF EVALUATION

GOAL I. Select the letter of the correct answer.

I

1. The dissolving medium in a solution is the _____.
   (a) solute (b) suspended phase (c) solvent (d) precipitate

2. Ethyl Alcohol and ether are _____.
   (a) immiscible (b) completely soluble (c) completely miscible (d) slightly soluble in each other

3. A solution in which the dissolved solute and the undissolved solute are in equilibrium is _____.
   (a) saturated (b) dilute (c) concentrated (d) miscible

4. Evaporation of a solvent from a solution of a solid in a liquid causes the solution to become _____.
   (a) more concentrated (b) more dilute (c) supersaturated (d) unsaturated

5. All mixtures of gases are _____.
   (a) suspensions (b) colloidal dispersions (c) electrolytes (d) solutions

6. To determine if a solution is saturated, unsaturated or supersaturated _____.
   (a) heat it (b) stir it (c) add solvent (d) add solute

7. Adsorption means the _____.
   (a) concentration of a gas on the surface of a gas
   (b) concentration of a liquid on a gas
   (c) concentration of a gas, liquid or solid on a gas
   (d) concentration of a gas, liquis or solid on a solid or liquid

8. Molality means the concentration of a solution expressed in _____.
   (a) grams of solute per 1,000 grams of solvent
   (b) moles of solute per 1,000 grams of solvent
   (c) grams of solute per 100 grams of solvent
   (d) moles of solute per 100 grams of solvent

9. Normality means the concentration of _____.
   (a) a solid in a liquid measured in liters
   (b) a solution expressed in liters
   (c) a solution expressed in gram equivalents of solute per liter of solution
   (d) a solution expressed in gram equivalent of solvent per liter of solution

10. The example of a suspension that does not exist is _____.
    (a) liquid in a gas
    (b) gas in a liquid
    (c) gas in a solid
    (d) gas in a gas

Self Evaluation (con't from p. 6)

GOAL II

II. 1. The solubility of solids depends upon all of these except ____.
(a) nature of the solid
(b) solvent used
(c) temperature
(d) pressure

2. As the pressure increases, the solubility of gases _____.
(a) increases
(b) decreases
(c) remains the same
(d) varies randomly

3. Increasing the temperature causes the solubility of gases in water to _____.
(a) increase slightly
(b) decrease
(c) remain the same
(d) increase greatly

4. Lowering the temperature of a saturated solution of sugar in water causes _____.
(a) sugar crystals to separate from the solution more slowly than the solid crystals dissolve
(b) sugar crystals to separate from the solution faster than the solid crystals dissolve
(c) solid crystals to dissolve more rapidly
(d) sugar crystals to separate more slowly

5. Gases are most soluble in water at _____.
(a) high temperature low pressure
(b) low pressure, low temperature
(c) low temperature, high pressure
(d) high pressure, high temperature

6. Most solids have positive heats of solution and _____.
(a) are more soluble in cold water
(b) give off heat when dissolved
(c) are more soluble in hot water
(d) are more ordered in solution than as solids

GOAL III

III. 1. The number of phases in a colloidal suspension is at least _____.
(a) 1 (b) 2 (c) 3 (4) 4

2. The range of particle size in a colloidal state is from ____.
(a) A° to 10 A°
(b) 10 A° to 1,000 A°
(c) 100 A° to 1,000 A°
(d) 1 A° to 10,000 A°

Self Evaluation (con't from p. 7)

3. A colloidal suspension may be prepared by mixing water with _____.
   (a) gelatin
   (b) dextrose
   (c) sugar
   (d) table salt

4. In a colloidal suspension, the dispersing medium _____.
   (a) must be a liquid
   (b) may be a solid
   (c) cannot be a gas
   (d) is always a solution

5. The scattering of light by a colloidal dispersion, when light is passed through it in a dark room illustrates _____.
   (a) dialysis
   (b) electrophoresis
   (c) Brownian Movement
   (d) Tyndall effect

6. Brownian movement is an indication that colloidal particles are _____.
   (a) attracted to ions
   (b) bombarded by molecules
   (c) struck by light
   (d) activated by heat

GOAL IV

IV. Complete on the types of solutions

	Solute	Solvent	Example
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			

GOAL V

V. A. Give the two colloidal dispersions for the following:

a. fog _____
b. Jelly _____
c. mayonnaise _____
d. whipped cream _____
e. ivory soap _____
f. smoke _____

B. Explain saturated solution in terms of solution equilibrium.

_____

_____

Self Evaluation (con't from p. 8)

GOAL VI VII

VI. A. State 3 ways to condensate solute particles to colloidal size.

(a) _____

(b) _____

(c) _____

B. Give the 4 general methods of getting particles to colloidal size.

(a) _____

(b) _____

(c) _____

(d) _____

GOAL VI VII

VII. Select the letter of the correct answer.

1. The milky colloid latex obtained from the rubber tree is coagulated by adding _____.
   (a) nitric acid
   (b) ammonia
   (c) additional latex
   (d) acetic acid

2. In order to precipitate soap _____ is added to the suspension.
   (a) ammonium chloride
   (b) sodium chloride
   (c) sodium hydroxide
   (d) ammonium hydroxide

3. When hydrogen peroxide is added to a water solution of hydrogen sulfide, sulfur precipatates out and is a colloid because _____.
   (a) it passes through filter paper
   (b) it does not pass through the filter paper
   (c) it settles to the bottom
   (d) it rises to the top

4. Suspensoids that have water as the suspending medium are called _____.
   (a) organosols
   (b) hydrosols
   (c) aerosols
   (d) germisols

Self Evaluation (con't from p. 9)

5. Aerosols are suspensions which have for the dispersing medium _____.
   (a) a liquid
   (b) a semi-solid
   (c) a hydrosol
   (d) a gas

6. The solvation of emulsoids accounts for _____.
   (a) change in viscosity
   (b) change in temperature
   (c) change in hydration
   (d) change in pressure

7. The example that is not a gel is _____.
   (a) gelatin
   (b) dynamite
   (c) film
   (d) pectin

8. Most emulsoids are characteristically _____.
   (a) organic materials
   (b) positively charged
   (c) irreversible
   (d) easily precipitated by electrolytes

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IONIZATION

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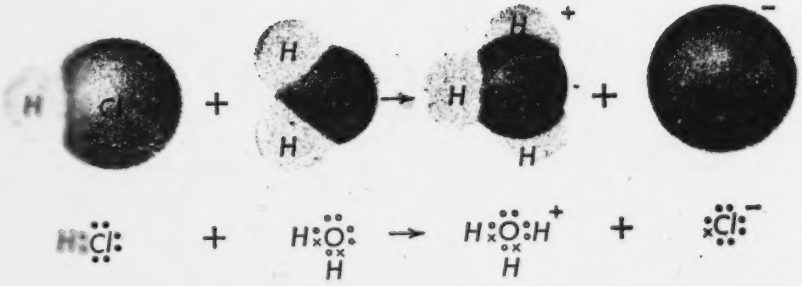


Ninety Six High School
Ninety Six, S.C. 1001

Chemistry I

REVIEWED [illegible]

LAP NUMBER 27

WRITTEN BY N. Jones

SE 014 425

RATIONALE (REASON WHY)

Svante August Arrhenius
(1859-1927)

Svante Arrhenius won a nobel prize for his theory of Ionization which enhanced the study of solutions of acids and bases. His theory showed that solutions containing acids or bases conducted an electric current by releasing charged particles upon being dissolved.

Your next lap will be on Acids, Bases and Salts. Your understanding of acidic and basic properties will be made easier from studying ionization.

BEHAVIORAL OBJECTIVES:

After completing your program of study, you will be able to demonstrate your knowledge of the following objectives on a progress and/or a Lap test unless specified otherwise.

I. Define and give examples of the following:
   1. Ionization Theory
   2. Electrolyte
   3. Nonelectrolyte
   4. Hydronium ion
   5. Spectator ion
   6. Anion
   7. Cation
   8. Electrolysis

II. Be able to predict whether substances are strong electrolytes, weak electrolytes, or nonelectrolytes based upon your study of ionization.

III. Demonstrate your understanding of hydration of ions by comparing the dissociation process with the ionization process.

IV. Be able to list and discuss the factors that affect the degree of ionization

V. Draw a diagram of an electrolysis apparatus, label the anode, cathode and indicate the anions and cations.

VI. Write ionization equations for molecular substances in water and tell the common ion of each.

ACTIVITIES

I. References:

1. "Modern Chemistry" - Holt - pp. 202-215
2. "Concepts in Chemistry" - Harcourt
   pp. 260-262 (Ionic Equations)
   pp. 206-210
   pp. 218-219
   pp. 204 (Ionization Theory)
3. "Chemistry" - Prentice-Hall - pp. 290-291
4. "Chemical Systems" - McGraw-Hill - pp. 131, 12, 548, 145
5. "Fundamental Concepts" - Amsco - pp. 87, 335-336 (Electrolysis)
   pp. 178, 265 (weak and strong electrolytes)
   pp. 180 (spectator ions)
   pp. 277-278 (reactions)

II. Problems:

1. Laboratory Manual - pp. 47-48 - Exercise 13 - Ionization
2. Modern Chemistry Text - work on paper to hand in the following on page 214. Question 2, 3, 4, 15, 19, 22.

III. Experiments - Laboratory Manual - pp. 241-242, #41
   pp. 243-244, #42

IV. Magazine:

"Chemistry" - September 1971 - pg. 26 - "An Ion - Exchange Fable" by Rita Ho

Work Sheet to be handed in after completing your behavioral objectives.

Using a separate sheet of paper, write the answers to the following questions. Write complete, balanced equations for the reactions in questions one through six. In questions one to three write equations according to the example.

Dissociation of sodium chloride $Na^+ Cl^- \rightarrow Na^+ + Cl^-$

1. Dissociation of Copper II Nitrate
2. Dissociation of Iron III Sulfate
3. Dissociation of calcium bromide
4. Ionization of water
5. Production of hydronium ion by complete ionization of sulfuric acid
6. Ionization of the empirical form of aluminum chloride in water

* Explain briefly.

7. Liquid hydrogen chloride doesn't conduct electricity but hydrochloric acid does.
8. Give two methods of experimentally measuring the apparent degree of ionization.
9. Water is a polar molecule.
10. One class of electrolytes consists of compounds which because of their structure and nature should be 100% ionized in solution. However, experimental results indicate a degree of ionization less than 100%.

Self-Evaluation

I. Complete the blanks.

GOAL I

1. The "Theory of Ionization" was first proposed by _____.
2. A substance whose water solution will conduct electricity is called _____.
3. An atom or group of atoms that carries an electric charge is called _____.
4. A water solution of a substance that doesn't appreciably conduct electricity is _____.
5. A hydrated proton is called _____.
6. An ion in a reaction system which takes no part in the chemical action is _____.
7. An ion that is negative is _____.
8. An ion attracted to the cathode of an electrolytic cell is _____.
9. The using of electricity to separate compounds into simpler substances is _____.

II. A. In the space at the right tell whether the following are electrolytes or non electrolytes.

GOAL II

1. pure water _____
2. Ethanol _____
3. Sulfuric acid _____
4. Sugar (Sucrose) _____
5. Sodium hydroxide _____
6. Glycerol _____

B. Tell whether each of the following is a strong or weak electrolyte. 1. Na_2SO_4 _____

2. NaOH _____
3. $KClO_2$ _____

Self-Evalustion (con't from p. 4)

4. H_2SO_3 _____

5. $K C_2 H_3 O_2$ _____

III. Select the letter of the correct answer.

GOAL III

1. The addition of water to a solid ionic electrolyte results in _____. (a) dissociation (b) ionization (c) polarization (d) electron loss

2. The number of moles of ions produced by the dissociation of one mole of $Cr_2(SO_4)_3$ is _____. (a) 1 (b) 2 (c) 5 (d) 17

3. Ionic compounds will conduct an electric current when they are _____. (a) solidified (b) melted (c) frozen (d) dehydrated

4. Solutions of weak electrolytes are largely _____. (a) atomic (b) molecular (c) ionic (d) dilute

5. The extent of the ionization of water is _____. (a) slight (b) zero (c) great (d) dependent on the amount of solute

6. Solutions of strong electrolytes are predominantly _____. (a) atomic (b) molecular (c) ionic (d) macromolecular

IV. List the five factors affect the degree of ionization of a solution.

a. _____ b. _____

c. _____ d. _____

e. _____

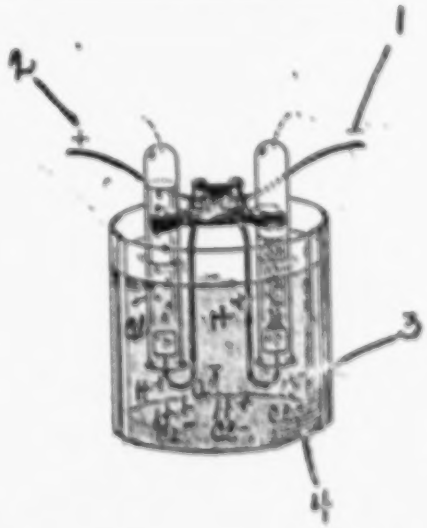
V. Label this electrolysis arparatus.

1. _____

2. _____

3. _____

4. _____



Self-Evaluation (con't from p. 5)

VI. In the space at the right, write the ionic equations for the dissociation of the electrovalent substances in water solutions.

1. $Na^{+}Cl^{-}$ →
2. $K_2^{+}\,S^{-}O_4^{-}$ →
3. $\overset{++}{Zn}\,(NO_3^{-})_2$ →
4. $K^{+}OH^{-}$ →
5. $Li^{+}Cl$ →

Advanced Study

I. A concentrated solution of a weak electrolyte differs markedly from a dilute solution of a strong electrolyte. Using ammonium hydroxide and sodium hydroxide as an example, explain the reasons for conductivity.

II. Whether sulfuric acid or sodium hydroxide is used as the electrolyte in the electrolysis of water, the reaction is essentially the same and results in twice as much hydrogen as oxygen. Explain why the results are independent of the electrolyte.

III. Arrange the following molecules in order of decreasing ionic character. PH_3, NH_3, $AlBr_3$, Rb Cl, CaS, MgO, GaSe, KCl, MaI, ICl.

IV. Represent pictorially the orientation of the anions surrounding one cation in each of the following: Li F, LiBr, KF, KBr.

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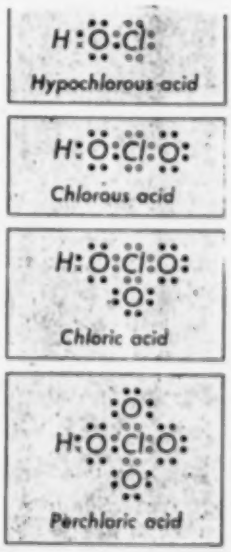

ACIDS, BASES, AND SALTS

Ninety Six High School
Ninety Six, S.C.

CHEMISTRY I

REVIEWED BY SR

LAP NUMBER 28

WRITTEN BY N. Jones

SE016 425

RATIONALE

In previous Laps we touched briefly on the preparation and properties of two classes of solutions of great importance - acids and bases. Their unique behavior can best be explained by applying your knowledge acquired by studying your Lap on Ionization. Acids have quite a dubious reputation, but their bark is worse than their bite. Everyone knows that acids must be handled with care, yet oranges contain two types of acids that are so weak they could be used to make an eyewash. Why are some acids tame and others dangerous?

It's all a matter of equilibrium.

RESOURCES

I. A. Books

1. "Modern Chemistry" - Holt, Rinehart, Winston - pp. 216-250
2. "Concepts in Chemistry" - Harcourt, Brace - pp. 241-258
3. "Chemistry" - Silver Burdett - pp. 336-354
4. "General Chemistry" - Selwood - pp. 229-238
5. "Chemistry" - Prentice Hall - pp. 297, 302, 305, 312

B. Paperback

1. "Solving Problems in Chemistry" - Merrill - pp. 193-195
2. "General Chemistry Workbook" - Pierce and Smith - pp. 51-53, 56. 55, 57

II. Experiments:

"Exercises and Experiments in Chemistry" - Metcalfe, Williams, Caska

25 pg. 185
26 pg. 189
27 pg. 193
28 pg. 195
29 pg. 199
30 pg. 201
31 pg. 205

Resources con't

III. Filmstrips

EB 10818 Titration

500 - (a) Acids and Bases

(b) Chemistry of Sulfuric Acid

IV. Transparencies

Eyegate

540-003-23

540-003-24 Normal and Molar Solutions

ACTIVITIES

To be completed by all students.

I. Laboratory Manual - Exercise 14 - pp. 49-52

"Exercises and Experiments In Chemistry"

(Hand this in after completing the Lap before you take the Lap Test)

II. Write on paper the answers to the following questions to be handed in.

"Modern Chemistry" - pp. 247-249

Questions 4, 5, 9, 24, 30

III. Solve these problems - pg. 249 in "Modern Chemistry"

Problems 1 and 2.

IV. Be certain to learn

1. six general ways to prepare acids + examples
2. five general ways to prepare bases + examples
3. five general ways to prepare salts + examples

Self-Evaluation

Acids, Bases and Salts - Lap 28

I. Supply the word that best completes the definition.

GOAL I

1. The process of combining of a solution of unknown concentration with a solution of known concentration _____

2. The characteristic of an hydroxide or carbonate of a Group I metal _____

3. The structure formed when a base acquires a proton _____

4. The concentration of a solution expressed in moles of solute per liter of solution _____

5. The concentration of a solution expressed in gram-equivalents of solute per liter of solution _____

6. Capable of acting either as an acid or as a base _____

7. The hydronium ion index _____

8. The resultant when an acid donates a proton _____

9. A solution of OH^- ions formed when an oxide reacts with water _____

10. The resultant of removing water from an acid _____

11. The stronger an acid, the weaker its conjugate base; and the stronger a base, the weaker its conjugate base _____

12. A complex organic substance having the ability to change color at a neutral point _____

II. Select the correct letter:

1. The most common base is the (a) hydrogen ion (b) hydronium ion (c) hydroxide ion (d) ammonium ion _____

2. A compound formed by a positive metallic ion and a negative ion, other than hydroxide, is a (n) (a) acid (b) base (c) salt (d) sugar _____

Self-Evaluation con't

3. A base is a(n) (a) proton donor (b) proton acceptor (c) electron donor (d) electron acceptor _____

4. The compound formed when an active metal replaces the hydrogen of an acid is (a) a hydride (b) a base (c) a salt (d) an anhydride _____

5. In an acid solution, litmus paper will be (a) red (b) blue (c) purple (d) colorless _____

6. A salt can be formed by the reaction between each of the following except (a) a metallic oxide and an acid (b) an acid and a base (c) an active and an inactive metal (d) a metal and a non-matal _____

III. Complete the following on the characteristics of salts.

GOAL II

1. The general kind of ions found in salts are _____

2. All true salts are what kind of compounds? _____

3. All true salts in the solid state have what form of crystals? _____

4. What kind of substance are all true salts? _____

IV. A. Select the correct letter:

GOAL III

1. Water is an acid when it dissolves in (a) NH_3 (b) H_2SO_4 (c) HCl (d) CH_3OH _____

2. A hydrated proton is called the (a) hydronium ion (b) hydroxide ion (c) deuterium ion (d) hyperion _____

3. One compound formed when the oxide of a metal reacts with an acid is (a) a base (b) another acid (c) a salt (d) an acid anhydride _____

4. In reacting with HNO_3, water acts as a(n) (a) acid (b) base (c) salt (d) anhydride _____

5. When an acid reacts with a base, what is formed? (a) a salt (b) water (c) salt and water (d) a salt and an acid ____

6. Acids react with certain metals forming (a) hydrogen + a base (b) hydrogen + a salt (c) hydronium + a base (d) hydronium + hydrogen _____

Self-Evaluation con't

7. A base is composed of (a) positive hydrogen ions combined with negative non-metallic ions (b) negative hydroxide ions and metallic positive ions (c) negative oxygen ions and negative non metallic ions (d) positive hydrogen ions combined with metallic ions _____

8. Acids (a) release hydrogen ions or form hydrogen ions (b) release hydronium ions or form hydrogen ions (c) release hydronium ions (d) form hydrogen ions _____

B. Give the formula and name of the salts formed by the following reactions:

1. Sodim hydroxide and phosphoric acid _____ _____

2. Potassium hydroxide and hydrochloric acid _____

_____

3. Lithium hydroxide and silicic acid _____ _____

V. A. Name the following acids.

GOAL IV

1. HBr _____
2. H_2SO_3 _____
3. HNO_3 _____
4. H_3PO_4 _____
5. $HClO_4$ _____

B. Name the following bases.

1. $CO(OH)_2$ _____
2. $Sn(OH)_2$ _____
3. $Ca(OH)_2$ _____

C. Name the following salts

1. $SrCO_3$ _____
2. KBr _____
3. Sb_2S_3 _____
4. $Hg(CN)_2$ _____

Self-Evaluation con't

VI. Which of the following salts are soluble, and which are insoluble in water?

1. NaCl _____
2. $CaCO_3$ _____
3. $BASO_4$ _____
4. $(NH_4)_2S$ _____
5. Ag_2SO_4 _____
6. CuS _____

VII. GOAL VI

1. What indicator is the best to use on a strong acid and a strong hydroxide? _____
2. What other indicator may be used on a strong acid and a strong hydroxide? _____
3. What indicator is best used with a weak acid and a strong hydroxide? _____
4. What indicator is used with a strong acid and weak hydroxide that has a pH of less than 7? _____

VIII. Write general ways to form an acid. GOAL III

a. _____
b. _____
c. _____
d. _____
e. _____
f. _____